MODIS Land Surface Temperature (LST) & Emissivity

Product Description

This Level 2 and 3 product contains land surface temperature and emissivity retrieved at spatial resolutions of 1 km and 5 km over global land surface. Both daytime and nighttime land surface temperatures are included in its daily product. Daily, 8-day, and monthly Level 3 products will be also generated at equal-angle grids of half degree latitude and longitude. For land covers (including dense evergreen canopies, lake surface, snow, ice, and most soils) with high and stable emissivities in the split-window range, a view-angle dependent generalized split-window LST algorithm will be used to retrieve the surface temperature. For these land covers, the accuracy of the generalized split-window LST algorithm is better than 1K in most cases. This LST algorithm is optimized by separating the ranges of atmospheric column water vapor, lower boundary temperature, and the surface temperature into tractable subranges. For other land covers with variable emissivities, a physics-based day/night LST algorithm will be used to simultaneously retrieve surface band emissivities and temperatures from a pair of daytime and nighttime observations in seven MODIS TIR bands through a statistical regression approach and/or a least-square fit approach. Input data for the MODIS LST algorithms include the following MODIS products: Level 1A geolocation and 1B TIR radiance; Level 2 cloud mask, atmospheric temperature and water vapor profiles, snow, sea ice, and NDVI; and the previous quarter's Level 3 land-cover product.

Research & Applications

Land surface temperature is a good indicator of both the energy balance at the Earth's surface and the greenhouse effect because it is one of the key parameters in the physics of the land-surface processes. It is required for a wide variety of climate, hydrological, ecological, and biogeochemical studies. This product will be used in generating other MODIS land products and in a variety of EOS interdisciplinary studies.

Data Set Evolution

During the past decade significant progress has been made in estimating land-surface emissivity and temperature from airborne thermal IR data, including multichannel, thermal log residual, and alpha residual methods. Three types of methods have been developed to retrieve LST from space: the single IR channel method, the split-window method which is also used in various multichannel sea-surface temperature algorithms, and a new day/night MODIS LST method which is designed to take advantage of the unique capability of the MODIS instrument. The strategy for development of the MODIS LST algorithms incorporates experience from the SST algorithms, surface emissivity knowledge base from laboratory and field measurements, accurate radiate transfer simulations, and efficient look-up table anderpolation scheme for operational production.

MOD 11 PRODUCT SUMMARY

Coverage:

global land surface

Spatial/Temporal Characteristics:

1 km, daily Level-2 LST
1 km and 5 km, daily Level-3 LST
1-degree latitude and longitude, daily, 8-day, and monthly Level-3 LST

Key Science Applications:

inputs to climate, hydrological, ecological modeling

Key Geophysical Parameters:

land-surface temperature (MODIS parameter 2484); land-surface emissivity (MODIS parameter 3323)

Processing Level:

2, 3

Product Type:

standard, at-launch

Science Team Contact:

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Fire Occurrence, and Volcanic Effects

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Suggested Reading

Running, S.W., *et al.*, 1994.

Salisbury, J.W. and D.M. D'Aria, 1992.

Snyder, W. and Z. Wan, 1996.

Wan, Z. and J. Dozier, 1989.

Wan, Z. and J. Dozier, 1996.